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ORIGINAL ARTICLE

Wolf spiders (Araneae: Lycosidae) from Xishuangbanna Tropical Botanical Garden, China

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Abstract Lycosidae collected from Xishuangbanna Tropical Botanical Garden (XTBG) of Chinese Academy of Sciences (CAS) in Huludao, Menglun Town, Mengla County, Yunnan Province, China are studied. A total of 14 wolf spiders species are reported, including one new species: *Arctosa zhaojingzhaoi* **sp. nov.** (♂♀). Type of *Arctosa gougu* is re-examined and photographed. *Trochosa menglaensis* Yin, Bao & Wang 1995 **syn. nov.** is synonymised with *T. bannaensis* Yin & Chen, 1995. Male of *T. bannaensis* is reported for the first time.

Key words Tropical forest, southern Yunnan, distribution.

1 Introduction

Lycosidae is one of the most diversified spider families in the world, which contains 2398 species belonging to 123 genera worldwide and 310 species belonging to 26 genera from China (World Spider Catalog, 2016). Spiders of the family Lycosidae from Xishuangbanna Tropical Botanical Garden in Huludao are studied in this paper, and one new species of wolf spiders is reported.

Xishuangbanna in southern Yunnan belongs to the transitional zone from tropical southern Asia to subtropical East Asia, and the spider species diversity of this area is very high (Zheng *et al.*, 2015; Zheng & Li, 2015). So far, 58 lycosid species belonging to 12 genera have been recorded in Yunnan Province (Li & Lin, 2015).

2 Material and methods

Spiders were collected from Xishuangbanna Tropical Botanical Garden of Chinese Academy of Sciences. Collections were made throughout the year by Guo Zheng from July 2006 to August 2007, and fresh material was collected by Zhigang Chen, Fei Pan, Chang Liu and Yunchun Li in recent years. Specimens were examined with a Leica M205C stereomicroscope. Further details were studied under a BX51 compound microscope. Photos were taken with an Olympus c7070 wide zoom digital camera (7.1 megapixels) mounted on an Olympus BX51 compound microscope. The multifocus images were assembled using Helicon Focus software version 3.10© (Helicon Soft Ltd.). All measurements are given in millimetres (mm).

Left male palps were photographed. Epigynes were removed and cleared in lactic acid or warm 10% potassium hydroxide (KOH) solution before photographing. All embolic divisions and vulvae were imaged after being embedded in Arabic gum. Eye diameters were taken at the widest point. Leg measurements are shown as: total length (femur, patella, tibia,

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metatarsus, tarsus). Distribution records were given in alphabetic order.

The following abbreviations are used:
ALE—anterior lateral eyes;
AME—anterior median eyes;
BS—base of septum;
CD—copulatory ducts;
CO—copulatory opening;
d—dorsal;
Em—embolus;
FD—fertilization ducts;
Ho—hood;
LA—lateral apophysis;
p—pretrolateral;
PLE—posterior lateral eyes;
PME—posterior median eyes;
Pa—palea;
r—retrolateral;
Re—receptacle;
S—stem of septum;
TA—tegular apophysis;
Te—tegulum;
v—ventral;
HNU—Hunan Normal University;
IZCAS—Institute of Zoology, Chinese Academy of Sciences;
XTBG—Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences.

3 Taxonomy

Family Lycosidae Sundevall, 1833

3.1 Genus *Arctosa* C.L. Koch, 1847

3.1.1 *Arctosa gougu* Chen & Song, 1999 (Fig. 1)

Arctosa gougu Chen & Song, 1999: 138, figs 1–3 (♀); Wang *et al.*, 2012: 57, figs 4A–D, 5A–G, 6A–B, 7A–F (♂♀).

Types examined. Holotype ♀, China, Yunnan, Menglun Town, XTBG, 04.11.1988, rain forest, pitfall traps.
Description. Photos are based on holotype (Fig 1A–E). Well described by Wang *et al.* (2012).
Distribution. China (Yunnan).

3.1.2 *Arctosa zhaojingzhaoi* Li, sp. nov. (Figs 2–3)

Type material. Holotype. ♂, China, Yunnan, Menglun Town, XTBG, 21°55.035′N, 101°16.500′E, elev. 558 m, 1–15.06.2007, primary tropical seasonal rain forest, pitfall traps. Paratypes. 2♀, same data as holotype; 1♀, 21°55.608′N, 101°16.038′E, elev. 633 m, 1–15.07.2007, secondary tropical seasonal moist forest, pitfall traps; 2♂, 21°54.200′N, 101°16.923′E, elev. 608 m, 16–31.07.2007, *Paramichelia baillonii* plantation, pitfall traps.

Etymology. The specific name is a patronym in honor of Prof. Jingzhao Zhao for his 80 birthday. Prof. Zhao is the founder on the study of spider ecology in China; noun (name) in genitive case.

Diagnosis. Male of the new species can be distinguished from *A. depectinata* (Bösenberg & Strand, 1906; Wang *et al.*, 2012 (54–56, figs 1–3, 13)) by the longer and falciform tegular apophysis; the cemicircular and larger palea (1/2 length of bulb) while *A. depectinata* has irregular and smaller palea (1/3 length of bulb); the subtegulum round while indistinct in the latter (Figs 1A–D). The female can be distinguished by the absent hoods, the shorter and axe-like septum and the narrower and longer copulatory opening (Figs 2A–B).

Figure 1. *Arctosa gougu*, female holotype. A. Epigyne, ventral view. B. Epigyne, dorsal view. C. Habitus, dorsal view. D. Habitus, ventral view. E. Habitus, lateral view. Scale bars: A–B = 0.10 mm; C–E = 1.00 mm.

Figure 2. *Arctosa zhaojingzhaoi* **sp. nov.**, male palp, holotype. A. Ventral view. B. Retrolateral view. C. Embolic division, ventral view. D. Bulb, retrolateral view. Scale bars: A–B, D = 0.10 mm; C = 0.05 mm.

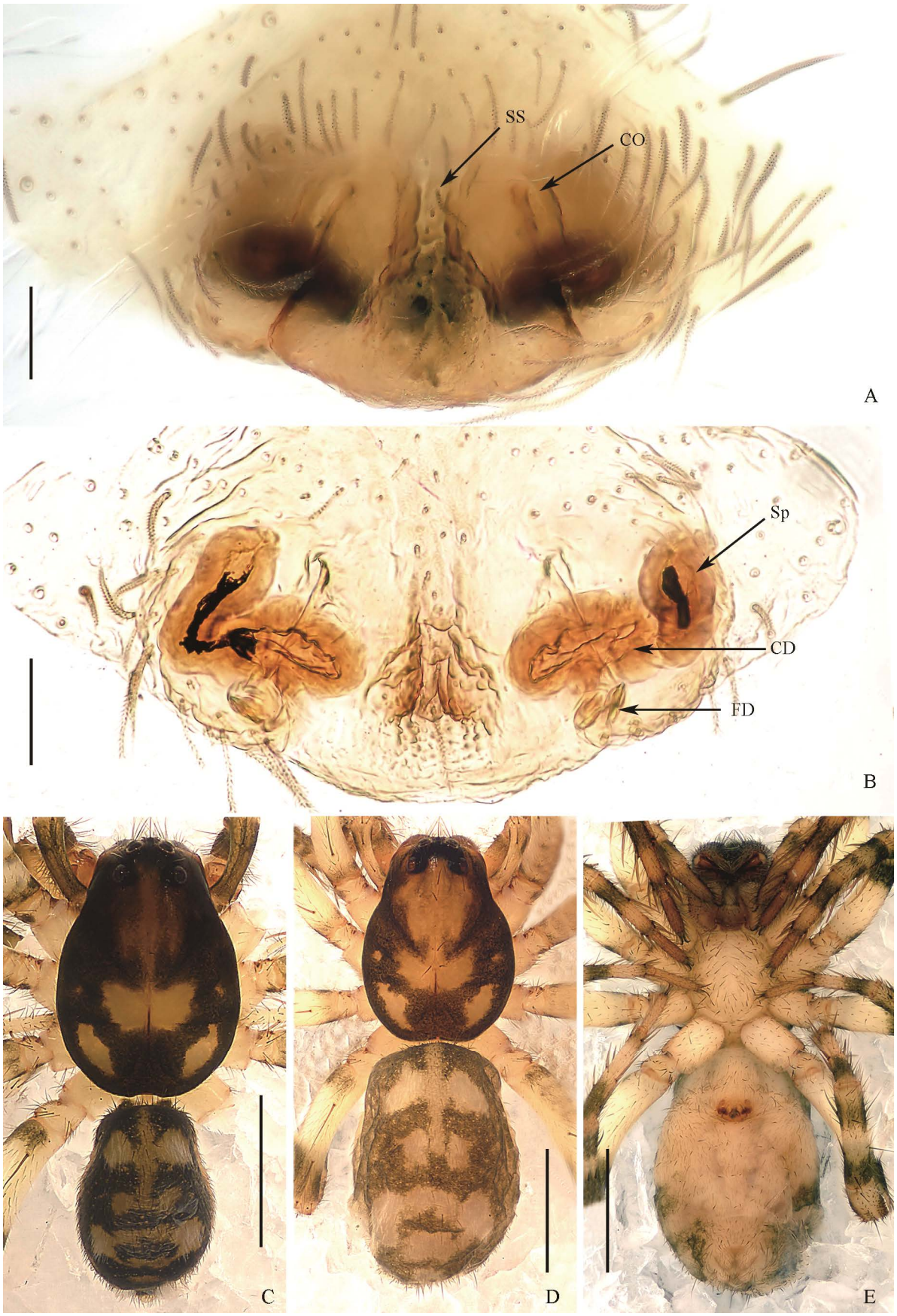

Figure 3. *Arctosa zhaojingzhaoi* **sp. nov.**, female paratype and male holotype. A. Epigyne, ventral view. B. Epigyne, dorsal view. C. Male, habitus, dorsal view. D. Female, habitus, dorsal view. E. Female, habitus, ventral view. Scale bars: A=0.05 mm; B=0.10 mm; C–E=1.00 mm.

Description. Male (holotype). Total length 3.72 (2.89–3.85). Carapace 1.60 (1.60–1.67) long, 1.15 (1.03–1.21) wide. Abdomen 1.28 long, 0.77 wide. Sternum yellow. Clypeus 0.24 high. Carapace length/femur IV ratio 1.28 (1.09–1.28). Eye sizes and interdistances: AME 0.05, ALE 0.07, PME 0.14, PLE 0.13; AME-AME 0.05, PME-PME 0.08, AME-ALE 0.03, PME-PLE 0.10. Labium and endites, yellowish brown. Legs yellowish–brown, with black rings; length of legs: I 4.29 (1.25, 0.50, 1.04, 1.00, 0.50), II 3.58 (1.00, 0.40, 0.80, 0.88, 0.50), III 3.16 (0.88, 0.38, 0.55, 0.80, 0.55), IV 4.88 (1.28, 0.80, 1.12, 1.04, 0.64). Spination of leg I: femur 3d, 1p; patella 1p; tibia 2p 6v; tarsus 2d 3p 2r 4v. Carapace: yellowish brown, with regular black stripes, median band with some black spots and marginal almost black. Abdomen: dorsum dark brown, with distinct yellow cardiac mark in anterior half part, and with yellow regular markings in posterior part. Venter of abdomen yellow (Figs 2C–D). Palp (Figs 1A–B): cymbium brown with two large claws; cymbial tip about 1/3 length of cymbium; bulb is really twisted (clockwise); palea semicircular and simple; terminal apophysis absent; sperm duct long with 2 deep loops; tegular apophysis large and falcate; embolus long and slender,with slightly twist tip, base of embolus broad (Figs 1C–D).

Female (paratype). Total length 3.72 (2.69–3.85). Carapace 1.67 (1.41–1.67) long, 1.15 (1.15–1.35) wide. Abdomen 1.92 long, 1.28 wide. Clypeus 0.38 height. Carapace length/femur IV ratio 1.30 (1.04–1.30). Eye sizes and interdistances: AME 0.06, ALE 0.07, PME 0.13, PLE 0.15; AME-AME 0.04, AME-ALE 0.04, PME-PME 0.09, PME-PLE 0.10. Labium and endites, yellowish brown. Length of legs: I 3.24 (1.00, 0.40, 0.84, 0.56, 0.44), II 3.00 (0.88, 0.40, 0.64, 0.60, 0.48), III 2.85 (0.90, 0.40, 0.50, 0.60, 0.45), IV 4.28 (1.28, 0.60, 1.00, 0.92, 0.48). Spination of leg I: femur 3d, 1p; patella 1p; tibia 2p 5v; tarsus 2d 2p 2r 4v. Colouration and pattern similar to those of the male except the body color lighter (Figs 2D–E). Epigyne (Figs 2A–B) with an anchor-shaped septum, the stem long and covered by setea, about 1/2 length of septum; hoods absent; receptacles oval, with a thin head; stalks of receptacles curved in the middle part; fertilization ducts long and obviously crooked.

Distribution. China (Yunnan).

3.2 Genus *Hippasa* Simon, 1885

3.2.1 *Hippasa holmerae* Thorell, 1895

Hippasa holmerae Thorell, 1895: 218 (♂♀); Wang *et al.*, 2015: 235, figs 3A–D, 4A–G (♂♀).

Material examined. 1♀, China, Yunnan, Menglun Town, XTBG, 21°54.200′N, 101°16.923′E, elev. 608 m, 16–31.07. 2007, *Paramichelia baillonii* plantation, by pitfall trap.

Description. Well described by Wang *et al.* (2015).

Distribution. China (Yunnan), India, Philippines.

3.2.2 *Hippasa lycosina* Pocock, 1990

Hippasa lycosina Pocock, 1900: 250 (♀); Wang *et al.*, 2015: 240, figs 7A–D, 8A–G (♂♀).

Material examined. 1♀, China, Yunnan: Menglun Town, XTBG, 08.07.1983.

Description. Well described by Wang *et al.* (2015).

Distribution. China (Yunnan) , India, Laos.

3.3 Genus *Hogna* Simon, 1885

3.3.1 *Hogna trunca* Yin *et al.*, 1996

Hogna trunca Yin *et al.*, 1996: 6, figs 4–12 (♂♀).

Material examined. 1♂, China, Yunnan, Menglun Town, XTBG, 21°55.551′N, 101°16.923′E, 561 m, 16–31.05.2007, rubber-tea plantation, pitfall traps; 3♂ 2♀, 21°54.772′N, 101°16.043′E, 556 m, 1–15.07.2007, *Paramichelia baillonii* plantation, pitfall traps; 1♀, 21°54.684′N, 101°16.319′E, 585 m, 19–26.04.2007, rubber plantation, by hand.

Description. Well described Yin *et al.* (1996).

Distribution. China (Yunnan, Zhejiang).

3.4 Genus *Lycosa* Latreille, 1804

3.4.1 *Lycosa grahami* Fox, 1935

Lycosa grahami Fox, 1935: 455, fig. 3 (♀); Yin *et al.*, 1997: 125, figs 58a–f (♂♀); Song *et al.*, 1999: 321, figs 191H, O (♂♀).

Material examined. 1♀, China, Yunnan, Menglun Town, Xishuangbanna NR.
Description. Well described by Song *et al.* (1999).
Distribution. China (Sichuan, Yunnan).

3.5 Genus *Lysania* Thorell, 1890

3.5.1 *Lysania pygmaea* Thorell, 1890

Lysania pygmaea Thorell, 1890: 313 (♀); Li *et al.*, 2013: 25, figs 1A–D, 2A–J (♂♀).

Material examined. 1♂ 1♀, China, Yunnan, Menglun Town, XTBG, 21°54.607′N, 101°17.005′E, 633 m, 4–11.05.2007, secondary tropical seasonal moist forest, by hand; 2♂ 1♀, 21°53.823′N, 101°17.072′E, 613 m, 4–11.04.2007, *Paramichelia baillonii* plantation, by hand; 4♀, 21°54.767′N, 101°11.431′E, 880 m, 19–26.04.2007, secondary tropical montane evergreen broad-leaved forest, by hand.
Description. This species is well studied and illustrated by Li *et al.* (2013).
Distribution. China (Yunnan), Malaysia, Borneo.

3.6 Genus *Pardosa* C. L. Koch, 1847

3.6.1 *Pardosa procurva* Yu & Song, 1988

Pardosa procurva Yu & Song, 1988: 30, figs 14–19 (♂♀).

Material examined. 1♂, China, Yunnan, Menglun Town, XTBG, 21°54.463′N, 101°15.978′E, 569 m, 1–15.06.2007, rubber-tea plantation, pitfall traps; 2♂ 3♀, 21°54.772′N, 101°16.043′E, 556 m, 1–15.07.2007, *Paramichelia baillonii* plantation, pitfall traps; 1♂, 21°57.445′N, 101°12.997′E, 744 m, 16–31.06.2007, primary tropical seasonal rain forest, pitfall traps; 1♂, 21°54.498′N, 101°16.326′E, 586 m, 1–15.07.2007, rubber plantation, pitfall traps; 3♀, 21°54.718′N, 101°16.940′E, 645 m, 1–15.07.2007, secondary tropical seasonal moist forest, pitfall traps.
Description. Well described by Yu & Song (1988).
Distribution. China (Guangxi, Taiwan, Yunnan, Zhejiang), India (West Bengal).

3.6.2 *Pardosa tuberosa* Wang & Zhang, 2014

Pardosa tuberosa Wang & Zhang, 2014: 231–232, figs 3A–E, 4A–J (♂♀).

Material examined. 1♂ 1♀, China, Yunnan, Menglun Town, XTBG, 21°54.498′N, 101°16.326′E, 586 m, 16–24.08. 2007, rubber plantation, pitfall traps; 2♂ 2♀, 21°54.463′N, 101°15.978′E, 569 m, 1–15.05.2007, *Paramichelia baillonii* plantation, pitfall traps; 1♂ 4♀, 21°54.646′N, 101°16.257′E, 572 m, 1–15.07.2007, rubber-tea plantation, pitfall traps; 5♀, 21°54.813′N, 101°12.334′E, 876 m, 1–15.07.2007, secondary tropical montane evergreen broad-leaved forest, pitfall traps.
Description. This species is well studied and illustrated by Wang & Zhang (2014).
Distribution. China (Yunnan).

3.6.3 *Pardosa pusiola* (Thorell, 1891)

Lycosa pusiola Thorell, 1891: 65 (♂♀).
Pardosa pusiola: Wang & Zhang, 2014: 233, figs 5A–D, 6A–J, 7A–B (♂♀).

Material examined. 1♀, China, Yunnan, Menglun Town, Xishuangbanna NR, date not detailed.
Description. This species is well studied and illustrated by Wang & Zhang **(**2014).
Distribution. China (Guangdong, Guangxi, Hubei, Jiangxi, Yunnan, Hainan), India, Sri Lanka, Indonesia and Malaysia.

3.7 Genus *Trochosa* C. L. Koch, 1847

3.7.1 *Trochosa bannaensis* Yin & Chen, 1995 (Figs 4–5)

Trochosa bannaensis Yin & Chen, in Yin *et al.*, 1995: 26, figs 9−13 (♀).
Trochosa menglaensis Yin *et al.*, 1995: 27, figs 14−18 (♀); Yin *et al.*, 1997: 154, figs 72a–d (♀); Song *et al.*, 1999: 345, fig. 201N (♀). **syn. nov.**

Type material examined. Holotype ♀, China, Yunnan, Xishuangbanna, 21.11.1989, deposited in Hunan Normal University (HNU), Changsha.

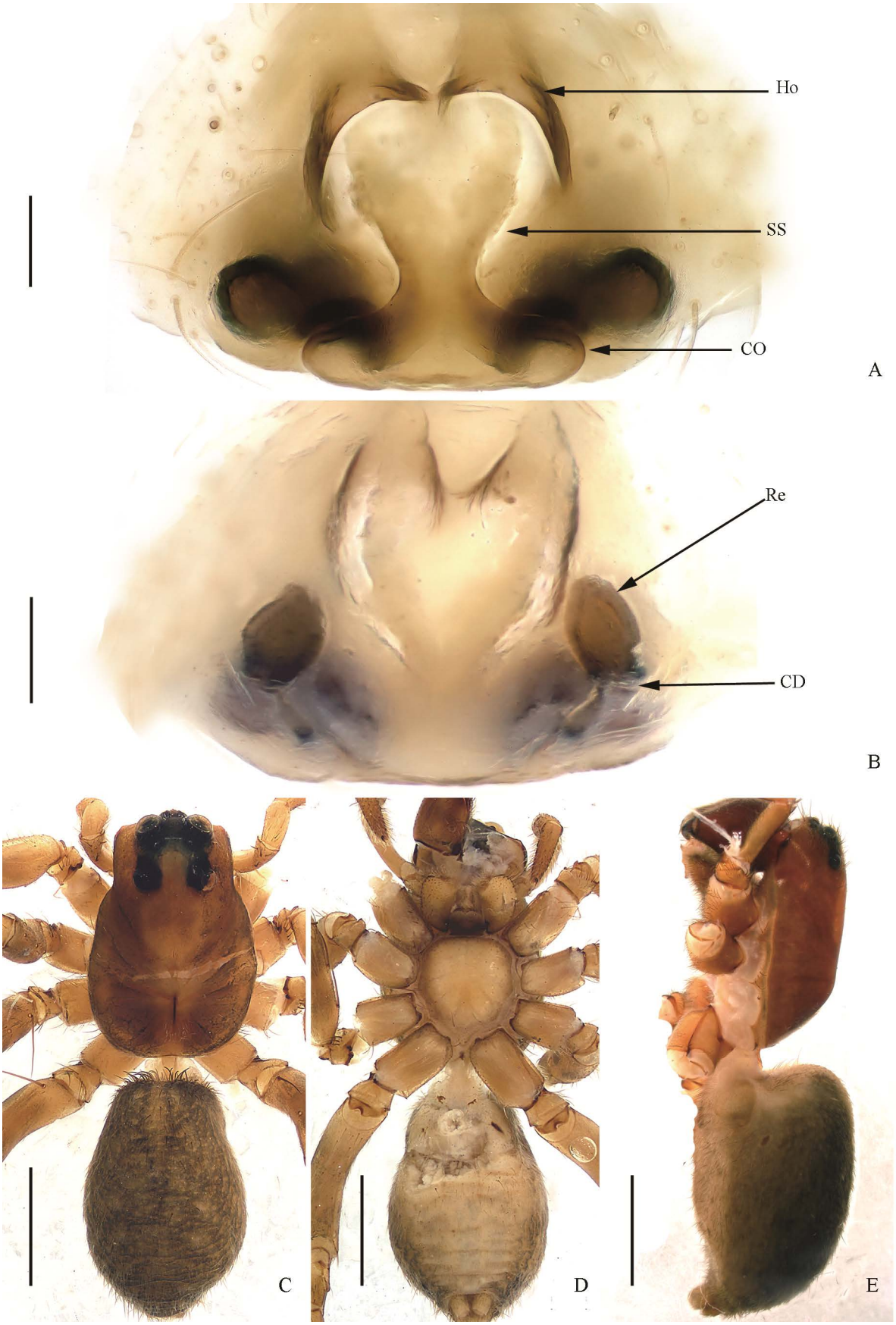

Figure 4. *Trochosa bannaensis*, female holotype. A. Epigyne, ventral view. B. Epigyne, dorsal view. C. Habitus, dorsal view. D. Habitus, ventral view. E. Habitus, lateral view. Scale bars: A–B = 0.05 mm; C–E = 1.00 mm.

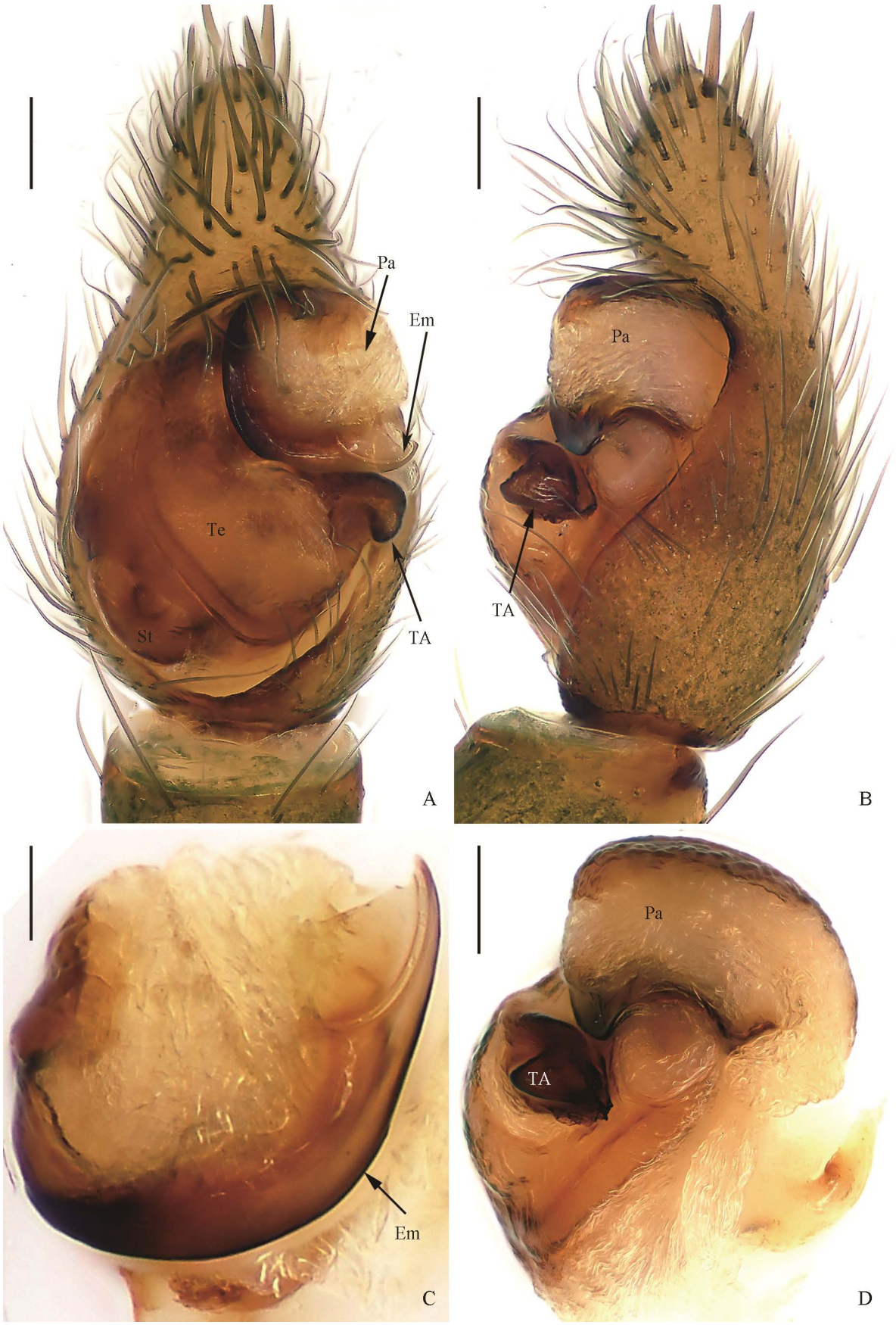

Figure 5. *Trochosa bannaensis*, male palp. A. Ventral view. B. Retrolateral view. C. Embolic division, ventral view. D. Bulb, retrolateral view. Scale bars: A–B, D = 0.10 mm; C = 0.05 mm.

Other material examined. 1♂ 2♀, China, Yunnan, Menglun Town, XTBG, 21°54.200′N, 101°16.923′E, 608 m, 16–31.05.2007, *Paramichelia baillonii* plantation, pitfall traps; 3♂ 5♀, 21°55.551′N, 101°16.923′E, 561 m, 16–31.05.2007, rubber-tea plantation, pitfall traps; 1♂ 4♀, 21°54.684′N, 101°16.319′E, 585 m, 16–31.06.2007, rubber plantation, pitfall traps; 1♂ 4♀, 21°53.823′N, 101°17.072′E, 613 m, 1–15.05.2007, primary tropical seasonal rain forest, pitfall traps.

Note. Male of the species is reported for the first time.

Distribution. China (Yunnan).

3.7.2 *Trochosa ruricoloides* Schenkel, 1963

Trochosa ruricoloides Schenkel, 1963: 350, figs 202a–b (♂); Yin *et al.*, 2012: 822, figs 412a–g (♂♀).

Material examined. 1♀, China, Yunnan, Menglun Town, Xishuangbanna NR.

Description. Well described by Yin *et al.* (2012).

Distribution. China (Taiwan).

3.8 Genus *Wadicosa* Zyuzin, 1985

3.8.1 *Wadicosa fidelis* (O. Pickard-Cambridge, 1872)

Wadicosa fidelis O. Pickard-Cambridge, 1872: 319 (♂); Kronestedt, 2015: 6, figs 3F, 5B, 6C–D (♂♀)

Material examined. 1♂ 1♀, China, Yunnan, Menglun Town, XTBG, 21°54.458′N, 101°16.726′E, 557 m, 1–8.01.2015, rubber plantation, by hand.

Description. This species is well studied and illustrated by Kronestedt (2015).

Distribution. Palaearctic.

3.9 Genus *Zoica* Simon, 1898

3.9.1 *Zoica unciformis* Li, Wang & Zhang, 2013

Zoica unciformis Li *et al.*, 2013: 30, figs 5A−E, 6A–H (♂♀).

Material examined. 3♂, China, Yunnan, Menglun Town, XTBG, 21°55.035′N, 101°16.500′E, 558 m, 19–26.05.2007, primary tropical seasonal rain forest, by hand; 1♂, 21°54.498′N, 101°16.326′E, 586 m, 1–15.07.2007, rubber plantation, pitfall traps; 1♂ 2♀, 21°55.428′N, 101°16.441′E, 598 m, 9–13.08.2006, secondary tropical seasonal moist forest, pitfall traps; 2♀, 21°54.463′N, 101°15.978′E, 569 m, 16–31.06.2007, rubber-tea plantation, pitfall traps.

Description. Well described by Li *et al.* (2013).

Distribution. China (Guangxi, Yunnan).

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